Appendix C

Firefinder Friendly Fire Mode

FIREFINDER MISSIONS

The secondary mission of Firefinder radars is to support friendly firing elements. This mission is performed only when the commander deems it absolutely necessary. The reason is that the secondary mission takes the radar away from its primary mission of locating hostile weapons. Also, it exposes the radar to possible location by hostile EW systems for other than its primary mission. In the friendly fire operational mode, Firefinder radars can provide accurate actual burst, datum-plane, or predicted-impact location data. These data allow firing elements to determine registration corrections for nonstandard conditions. Because the radar cannot radiate in friendly fire mode and hostile fire mode at the same time, the commander must issue specific guidance as to when and how friendly fire mode will be used. This determination is made based on METT-TC, availability of observers, and the ability of the supported unit to meet the requirements for accurate predicted fire.

FRIENDLY FIRE MODE

When operating in the friendly fire mode, the Firefinder radar sets up a horizontal "window" through which the projectile must pass. The window is referred to as the friendly fire search fence as shown in Figure C-1. For operations in friendly fire mode, the normal search fence of 1,600 mils (used in the hostile fire mode) is focused to a width of approximately 440 mils. The narrowed search fence provides the best probability of detecting and tracking rounds fired. The radar tracks projectiles until an airburst is detected, the selected datum plane altitude is intersected, or the radar has enough data to predict the point of impact.

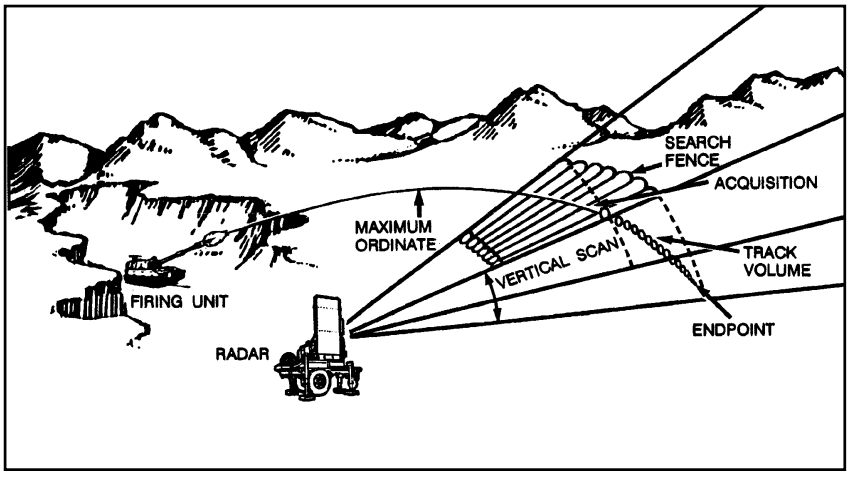

Figure C-1. Friendly Projectile Tracking

In the optimum friendly fire radar-tracking situation, the angle (angle-T) made by the radar-orienting point (radar-target) line and the gun-orienting point (gun-target) line is from 800 to 1,200 mils. See Figure C-2.

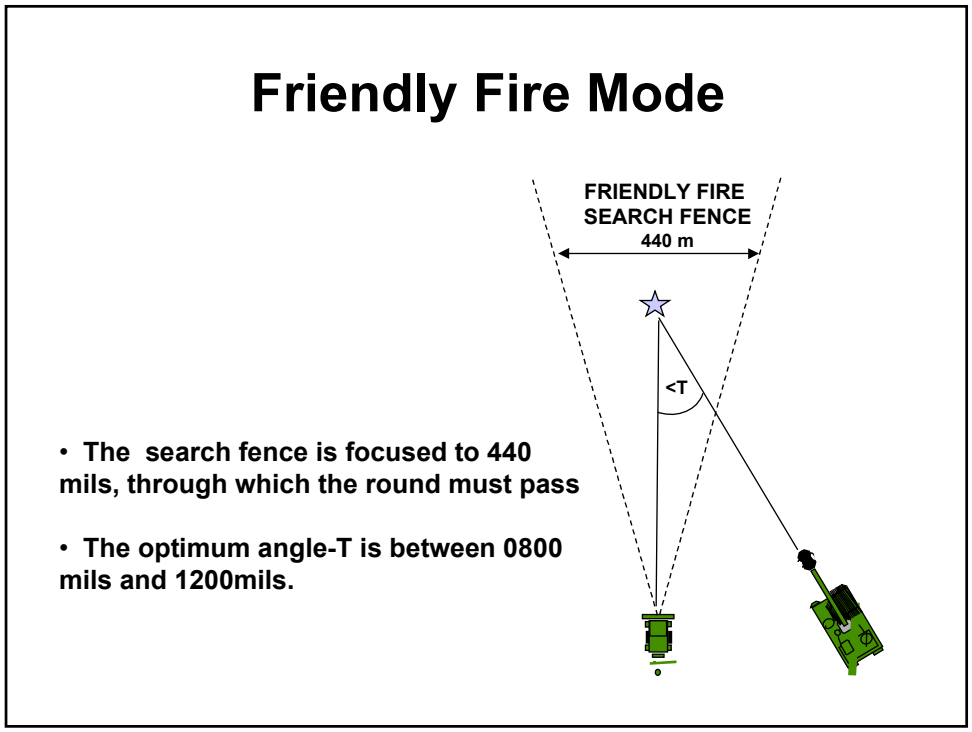

Figure C-2. Angle-T

Before the Firefinder radars can conduct a mission in friendly fire mode, specific information must be stored in the friendly fire buffer of the radar computer. Data required in the friendly fire buffer are as follows:

- Submode type of mission.
- Battery location (easting, northing, and altitude).
- Registration point location (easting, northing, and altitude).
- Maximum ordinate of the trajectory to the nearest meter from the appropriate tabular firing table (TFT) (maximum ordinate above gun).
- Quadrant elevation or fall angle from the TFT (Table G).
- Target number.

Orienting data required for the friendly fire buffer and for the actual conduct of the mission are contained in the FM;INTM and follow-up messages to observer (FM;MTO) received from BCS. During non-digital operations, the orienting data are transmitted by voice to the radar using VHF-FM radios. When the required data listed above are entered, the computer will either accept the search fence or reject it by showing an error message to the operator. The radar operator must then coordinate with the firing unit for adjustments to the firing data or orienting point that will allow the radar to

observe the rounds in the friendly fire mode. Legacy systems can store up to three sets of data in the friendly fire buffer for later use. The Q-36(V)8 can store six sets of data in the friendly fire buffer.

In friendly fire mode, the radar can perform three types of missions:

- Observe a high-burst (HB) registration (artillery airburst mode).
- Predict impact locations (artillery impact-predict mode).
- Observe a datum-plane registration (artillery datum-plane mode).

These friendly fire mode missions support the two types of registrations conducted by the FDC. The radar high-burst registration provides "did hit" observations for the FDC high-burst registration. The radar impact-predict and datum-plane registrations provide "did hit" observations for the FDC mean-point-of-impact (MPI) registration. The MPI calculations by the FDC differ for the two types of radar observation, because they correspond to different orienting points. All of these calculations are discussed in detail in FM 3-09.40 (6-40).

When operating in the friendly fire mode the radar provides friendly units with accurate actual burst, datum-plane, or predicted-impact location data. It has five different mission sub-modes that are used to provide this data. They are:

- Mortar datum plane (MD).
- Mortar impact prediction (MI).
- Artillery airburst (AA).
- Artillery datum plane (AD).
- Artillery impact prediction (Al).

The radar can also observe adjust fire missions. The observation functions performed by the radar to observe an adjust fire mission are the same as an impact predict registration.

HIGH-BURST REGISTRATION

For a high-burst registration, the high-burst altitude above the registration point is the actual orienting point for the radar. The high-burst altitude is located two probable errors in height above the registration point expressed up to the next 10 meters. The radar must be able to observe this point and begin tracking the trajectory of the round at least 350 meters before the burst. This ensures the radar can track the round to the burst point. If the radar cannot observe the orienting point, the radar operator will be notified by an error message. The radar section must then coordinate with the firing unit to select a new high-burst altitude (or orienting point for the radar) that meets the technical tracking criteria of the radar. The radar operator passes the grid coordinates and altitude of each observed burst to the firing unit. The firing unit must then determine registration corrections as it would for a regular high-burst registration.

IMPACT-PREDICT REGISTRATION (MEAN POINT OF IMPACT)

In an impact-predict mission, the radar uses the friendly fire mode to track the round on its descending trajectory toward the registration point and to predict where the round will impact without actually observing the ground burst. To provide data, the radar must track the round along its trajectory for a sufficient distance above the radar's screening crest. If the radar cannot track the round far enough along its trajectory, it will notify the operator that it has limited track coverage. Coordination must then be made with the firing unit to end the mission or to continue it by selecting a new registration point. The predicted burst locations are reported to the FDC, which then averages them as "did hit" data and compares them to the fired "should hit" data of the registration point to obtain MPI registration corrections.

DATUM-PLANE REGISTRATION (MEAN POINT OF IMPACT)

The datum-plane registration is a lesser-used capability of Firefinder radars. During a datum-plane registration, the FDC selects a registration point, for example, a grid intersection. The altitude for the datum-plane registration is the altitude of a selected horizontal datum plane above the registration point through which all rounds will pass. The radar must be able to observe the rounds in flight as they pass through this altitude. In calculating firing data, the FDC uses the altitude of the datum plane as the altitude of the registration point. If the radar cannot track along the trajectory for a sufficient distance to its datum-plane orienting point, the same error messages will be displayed to the operator as for a high-burst registration. The firing unit must then adjust the altitude of the target. When the radar observes the registration rounds, the coordinates reported to FDC are those of each penetration or intersection point of the datum plane at the datum plane altitude rather than the predicted location of impact. The FDC corrects the "should hit" data by the altitude difference between the datum plane and the actual registration point. The FDC must then compute registration corrections in the same way it would to obtain "did hit" data for an MPI registration. Detail procedures for the conduct of all friendly fire missions, digital formats and voice communications are outlined in FM 6-40. Procedures for manually recording fire mission data are provided and outlined under the friendly fire log.

FRIENDLY FIRE LOG

The radar operator uses DA Form 5310-R (Firefinder Friendly Fire Log) to record all the pertinent data for any type of friendly fire operation. The form is designed for use with either a digital or a conventional FDC. However, it is not necessary to use DA Form 5310-R when friendly fire missions are transmitted by digital means since all messages transmitted and received by the radar are recorded on the radar's printer. DA Form 5310-R should be used anytime a friendly fire mission is sent by voice or when the printer is not operational.

FIREFINDER FRIENDLY FIRE LOG

(TO BE USED WITH AN/TPQ-36/AN/TPQ-37)

(For use of this form, see FM 6-121. The proponent agency is TRADOC.)

SECTION I. MESSAGE TO OBSERVER

BLOCK					
1	RADAR MODE (CHECK APPROPRIATE BOX) ☐ AA: ARTILLERY, AIRBURST ☐ AI: ARTILLERY IMPACT PREDICT ☐ MI: MORTAR IMPACT PREDICT ☐ AD: ARTILLERY DATUM PLANE ☐ MD: MORTAR DATUM PLANE				
	UNIT		DATE-TIME GROUP		
2	UNIT LOCATION	EASTING	NORTHING	ALTITUDE	M / F
3	TARGET LOCATION END POINT	EASTING	NORTHING	ALTITUDE	M / F
4	MAXIMUM ORDINATE (HEIGHT ABOVE BATTERY ALTITUDE)	M / F	QUADRANT ELEVATION		
	TARGET NUMBER				
5	BUFFER NUMBER (CIRCLE ONE) 1 2				
6	FRIENDLY FIRE SEARCH FENCE (FFSF) ERROR MESSAGES (CHECK APPROPRIATE BOX[ES]) ☐ END POINT BEYOND 30 KM (Q-37)/24 KM (Q-36) ☐ TRAJECTORY INCORRECT ☐ END POINT _____M ABOVE MAXIMUM ☐ END POINT INSIDE 3 KM (Q-37)/1 KM (Q-36) ☐ END POINT ABOVE MAXIMUM ORDINATE ☐ END POINT _____M BELOW MINIMUM ☐ LIMITED TRACK COVERAGE				

SECTION II. MESSAGE TO FDC

(CHECK APPROPRIATE BOX[ES])

☐ AT MY COMMAND ☐ REQUEST SPLASH ☐ READY TO OBSERVE
☐ REQUEST SHOT ☐ REPORT WHEN READY ☐ ONE GUN

SECTION III. RECORD AND REPORT TO FDC

ROUND NUMBER	EASTING *a*	NORTHING *b*	ALTITUDE *c*	M / F	METHOD SENT *d*	TIME SENT *e*	ACKNOWLEDGED *f*
1							
2							
3							
4							
5							
6							
7							
8							
9							

REMARKS	TIME END OF MISSION RECEIVED	MISSION OBSERVED BY

DA FORM 5310-R

Figure C-3. Friendly Fire Log